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Attorney Docket No.: SP01-013

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Number: 6,768,856 B2

Patentees: Ikerionwu A. Akwani, et al

Serial No: 09/917039

Filed: 7/27/2001

For: HIGH GERMANIUM CONTENT WAVEGUIDE MATERIALS

Group Art Unit: 2874

Examiner: Michael J. Stahl

REQUEST FOR CERTIFICATE OF CORRECTION FOR PTO MISTAKE PURSUANT TO 35 U.S.C. § 254 AND 37 C.F.R. § 1.322

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is a request for the issuance of a Certificate of Correction in the above-identified patent. Two (2) copies of Form PTO 1050 are appended. The correction(s) involve(s) pages 13 and 14.

The mistakes identified in the appended Form occurred through the fault of the Patent Office, as clearly disclosed by the records of the application which matured into this patent.

Issuance of the Certificate of Correction is requested.

Respectfully submitted,

CORNING INCORPORATED

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Date: 17 August 2004

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner of Patents, P.O. Box 1450, Alexandria, VA 223131-1450 on

17 August 2004
Date of Deposit

Walter M. Douglas 17 Aug 2004
Signature

PATENT
Attorney Docket No.: SP01-013

(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6768856
DATED : 7/27/2004
INVENTOR(S) : SIMPSON LYNN B, et al

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

No.	*Col.*	*Line*	*Description*
1	13	38	"baying" should be "**having**" a refractive index
2	14	38	"come" should be "**core**" layer
3	14	41	Insert after --of from about -- before $3x10^{-60}$ "1.48 TO ABOUT 1.52 AT 1550 NM AND A COEFFIEIENT OF THERMAL EXPANSION OF FROM ABOUT"

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PATENT NO. 6,768,856

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PATENT
Attorney Docket No.: SP01-013

(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

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DATED : 7/27/2004
INVENTOR(S) : SIMPSON LYNN B, et al

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precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. The drawings and description were chosen in order to explain the principles of the invention and its practical application. It is intended that the scope of the invention be defined by the claims appended hereto, and their equivalents.

The invention claimed is:

1. A glass composition comprising:

a germanium-silicon oxynitride having a Ge/(Si+Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N+O) mole ratio of less than about 0.1.

2. The glass composition of claim **1**, wherein the Ge/(Si+Ge) mole ratio is about 0.35 and the N/(N+O) mole ratio is about 0.05.

3. The glass composition of claim **2** exhibiting a refractive index of from about 1.48 to about 1.52 at 1550 nm, and having a coefficient of thermal expansion at room temperature of from about $3\times10^{-6°}$ $C.^{-1}$ to about $4.4\times10^{-6°}$ $C.^{-1}$.

4. The glass composition of claim **1** exhibiting a refractive index of from about 1.48 to about 1.52 at 1550 nm, and having a coefficient of thermal expansion at room temperature of from about $3\times10^{-6°}$ $C.^{-1}$ to about $4.4\times10^{-6°}$ $C.^{-1}$.

5. A planar optical device comprising:

a waveguide core and waveguide cladding, wherein at least one of the waveguide core and the waveguide cladding is a germanium-silicon oxynitride glass having a Ge/(Si+Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N+O) mole ratio of less than about 0.1.

6. The planar optical device of claim **5**, wherein the Ge/(Si+Ge) mole ratio is about 0.35 and (N/(N+O) mole ratio is about 0.05.

7. The planar optical device of claim **6**, wherein the planar optical device is an optical switch having liquid crystal switches located at intersecting waveguides.

8. The planar optical device of claim **7**, wherein the planar optical device is a cross-connect optical switching device.

9. A method of forming a planar optical device on a silicon substrate, wherein the device includes a waveguide ~~baying~~ having a refractive index of from about 1.48 to about 1.52 at 1550 nm, and a coefficient of thermal expansion of from about $3\times10^{-6°}$ $C.^{-1}$ to about $4.4\times10^{-6°}$ $C.^{-1}$, comprising:

depositing on a silicon substrate by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride cladding layer having a Ge/(Si+Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N+O) mole ratio of 0 to about 0.1;

depositing on the cladding layer by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride core layer having a Ge/(Si+Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N+O) mole ratio of 0 to about 0.1, wherein the refractive index of the core layer is higher than the refractive index of the cladding layer.

10. The method of claim **9** further comprising annealing the cladding layer and the core layer to a temperature greater than 1,000° C. in an oxidizing atmosphere, and cooling the cladding layer and the core layer at a rate greater than 200° C./hr to a temperature below the strain point of the glass.

11. The method of claim **9** wherein the core layer and the cladding layer are deposited by exposing a substrate to a reaction gas mixture including a silicon precursor, a germanium precursor, a nitrogen source, and optionally including a carrier gas, wherein the plasma is formed by two electrodes driven by separate RF power supplies and a region of the chamber that is grounded, and wherein the substrate is placed on one of the electrodes that is driven with a RF power supply having a frequency less than 1 MHz, and the other electrode is driven with a RF power supply having a frequency greater than 1 MHz.

12. A planar optical device comprising:

a waveguide core and waveguide cladding, wherein at least one of the waveguide core and the waveguide cladding is a silica-germania-titania glass having a Ge/(Si+Ge+Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si+Ge+Ti) mole ratio of less than about 0.08.

13. The planar optical device of claim **12**, wherein the planar optical device is an optical switch having liquid crystal switches located at intersecting waveguides.

14. The planar optical device of claim **13**, wherein the planar optical device is a cross-connect optical switching device.

15. A method of forming a planar optical device on a silicon substrate, comprising:

depositing on a silicon substrate by plasma enhanced chemical vapor deposition a silica-germania-titania cladding layer having a Ge/(Si+Ge+Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si+Ge+Ti) mole ratio of 0 to about 0.08; and

depositing on the cladding layer by plasma enhanced chemical vapor deposition a silica-germania-titania core layer having Ge/(Si+Ge+Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si+Ge+Ti) mole ratio of from 0 to about 0.08, wherein the refractive index of the ~~come~~ core layer is higher than the refractive index of the cladding layer, (1) (2)

wherein the device includes a waveguide having a refractive index of from about missing $3\times10^{-6°}$ $C.^{-1}$ to about $4.4\times10^{-6°}$ $C.^{-1}$. (3)

16. The glass composition of claim **1**, wherein the glass composition consists essentially of oxides and nitrides of silica and germania.

17. The planar optical device of claim **5**, wherein the germanium-silicon-nitride glass consists essentially of oxides and nitrides of silica and germania.

18. The planar optical device of claim **12**, wherein the silica-germania-titania glass consists essentially of oxides of silicon, germanium and titanium.

19. The planar optical device of claim **12** wherein the silica-germania-titania glass has a refractive index of from about 1.48 to about 1.52 at 1550 nm and a coefficient of thermal expansion at room temperature of from about $3\times10^{-6°}$ $C.^{-1}$ to about $4.4\times10^{-6°}$ $C.^{-1}$.

* * * * *

9. A method of forming a planar optical device on a silicon substrate, wherein the device includes a waveguide having a refractive index of from about 1.48 to about 1.52 at 1550 nm, and a coefficient of thermal expansion of from about 3 x 10^{-6} °C^{-1} to about 4.4 x 10^{-6} °C^{-1}, comprising:

depositing on a silicon substrate by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride cladding layer having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1;

depositing on the cladding layer by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride core layer having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1, wherein the refractive index of the core layer is higher than the refractive index of the cladding layer.

10. The method of claim 9 further comprising annealing the cladding layer and the core layer to a temperature greater than 1,000 °C in an oxidizing atmosphere, and cooling the cladding layer and the core layer at a rate greater than 200 °C/hr to a temperature below the strain point of the glass.

11. The method of claim 9 wherein the core layer and the cladding layer are deposited by exposing a substrate to a reaction gas mixture including a silicon precursor, a germanium precursor, a nitrogen source, and optionally including a carrier gas, wherein the plasma is formed by two electrodes driven by separate RF power supplies and a region of the chamber that is grounded, and wherein the substrate is placed on one of the electrodes that is driven with a RF power supply having a frequency less than 1 MHz, and the other electrode is driven with a RF power supply having a frequency greater than 1 MHz.

14. A planar optical device comprising:

a waveguide core and waveguide cladding, wherein at least one of the waveguide core and the waveguide cladding is a silica-germania-titania glass having a Ge/(Si + Ge +

Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of less than about 0.08.

15. The planar optical device of claim 14, wherein the planar optical device is an optical switch having liquid crystal switches located at intersecting waveguides.

16. The planar optical device of claim 15, wherein the planar optical device is a cross-connect optical switching device.

17. A method of forming a planar optical device on a silicon substrate, comprising:

depositing on a silicon substrate by plasma enhanced chemical vapor deposition a silica-germania-titania cladding layer having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of 0 to about 0.08; and

depositing on the cladding layer by plasma enhanced chemical vapor deposition a silica-germania-titania core layer having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of from 0 to about 0.08, wherein the
2 refractive index of the core layer is higher than the refractive index of the cladding layer,

wherein the device includes a waveguide having a refractive index of from about
3 1.48 to about 1.52 at 1550 nm and a coefficient of thermal expansion of from about 3 x $10^{-6}\,°C^{-1}$ to about 4.4 x $10^{-6}\,°C^{-1}$.

18. The glass composition of claim 1, wherein the glass composition consists essentially of oxides and nitrides of silica and germania.

19. The planar optical device of claim 5, wherein the germanium-silicon oxynitride glass consists essentially of oxides and nitrides of silica and germania.

20. The planar optical device of claim 14 wherein the silica-germania-titania glass consists essentially of oxides of silicon, germanium and titanium.

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